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(54) Rotating joint for sprinklers.

(57) A rotating impact sprinkler comprises means for connecting a pressurized water column to a rotating joint which supports a rotating assembly (7) which is formed by a tubular body (8) with a nozzle (12) for generating a jet, an oscillating arm (20) and deflection means mounted at the end of the arm so as to interact with the jet. The deflection means comprise at least one main deflector (40) which oscillates elastically in a direction which is transverse to the arm between a central equilibrium position, in which the surface affected by the jet is minimal, and at least one lateral abutment position, in which the surface affected by the jet is maximal. The variation in cross section in passing from the minimal surface to the maximal one is sudden, so as to instantly increase the withdrawal of energy from the jet and generate impulsive forces on the deflector.

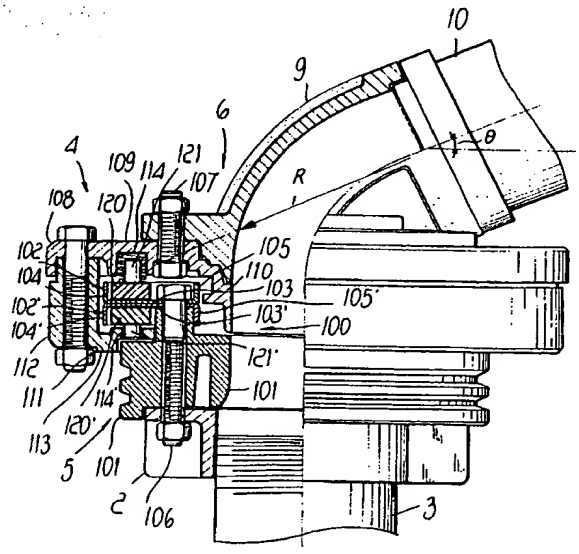

Fig. 2

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The present invention relates to a rotating joint for sprinklers, of the type used to perform irrigation on an entire circumference or on partial sectors.

Conventional sprinklers of this type are generally placed on trolleys, or supporting frames, and comprise means for connecting a pressurized water column to a rotating joint, which in turn supports an assembly which rotates about the axis of the joint. The assembly is essentially formed by a tubular body which has, at one open end, an adapted nozzle for generating a jet which is inclined with respect to the axis of rotation of the assembly. Propulsion and jet-breaking means are mounted on the tubular body and are generally constituted by one or more arms which oscillate about an axis which is substantially perpendicular to the axis of rotation of the assembly and have one end suitable for periodically interacting with the jet.

At the end affected by the jet, each oscillating arm is provided with one or more deflectors suitable for partially deflecting the jet, generating reaction forces which have components which are parallel and perpendicular to the axis of rotation of the assembly and cause a periodic oscillation of the arm and a stepwise rotary motion of the entire assembly.

In order to prevent the uncontrolled rotation of the assembly in excessively large incremental steps, which would not allow an effective irrigation, an adapted brake device is inserted in the rotating joint which supports the assembly, for contrasting the rotation of the assembly about its own main axis.

An essential requirement for sprinklers of the above described type is that the rotation rate of the rotating assembly must be approximately constant as the pressure and flow-rate of the jet and the attitude of the sprinkler vary. In fact, if the axis of rotation of the sprinkler is inclined with respect to the vertical, the components of the reaction forces and of the braking forces may vary, altering the rotation rate of the sprinkler, with consequent modifications and non-uniformities in the irrigation conditions.

Some sprinklers of the above described type are known which satisfactorily perform their task; however, they can furthermore be improved so as to eliminate some acknowledged disadvantages.

One of these disadvantages is constituted by the substantial non-uniformity in the operation of sprinklers at low water feed pressures, which become increasingly necessary in order to reduce facility management costs and in general to limit energy consumption. This non-uniformity in operation is furthermore always present in the initial startup step, since in practical use the pressure of the feed water must be increased gradually, passing from a minimum value to a maximum one. During this transient, the propulsion arm of the sprinkler, which is initially motionless, starts to oscillate with a limited frequency and extent which increase gradually up to the steady-state values. Correspondingly, the interruptions of the jet are initially nil or minimal and increase progressively until they become complete and constant. Now, if the sprinkler is not designed correctly, this transient condition can last for an excessively long and sometimes indefinite time, with the consequence that the jet is not interrupted and digs a hole in the ground, irreparably damaging the crops.

A further disadvantage of known sprinklers consists of the fact that the intervals for the adjustment of the oscillation frequency and of the rotation rate of the assembly are rather limited, unless the balancing of the oscillating arms is changed. In order to perform this operation, devices for modifying the position of the counterweights arranged on the arm are generally provided, but these mechanisms are very complicated and require the use of special tools or of universal implements which are not normally available in the place where the sprinkler is used.

The aim of the present invention is to overcome the disadvantages described above by a self adjusting rotating joint that provides a substantially constant rotation rate of the sprinkler, as the pressure and flow-rate of the water vary and as the inclination of the ground varies, even with considerable slope angles.

Another object of the invention is to provide a rotaing joint which allows to adjust the rotation rate, by virtue of means mounted directly on the sprinkler, without requiring any further external equipment.

Still a further object of the invention is to provide a substantially simple rotating joint for sprinklers which can be used by personnel having no particular knowledge of sprinklers and such as to require very little maintenance, so as to be advantageous from a merely economical point of view.

This aim, these objects and others which will become apparent hereinafter are achieved by a rotating joint for sprinklers of the type described in the introductory part and having the characteristics defined in the characterizing part of claim 1.

Further characteristics and advantages of the invention will become apparent from the description of a preferred but not exclusive embodiment of the rotating joint according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Fig. 1 is a general perspective view of a rotating sprinkler;

Fig. 2 is a partially enlarged sectional view of the brake device of the sprinkler according to

the invention, taken along a vertical plane which passes through the axis of rotation of the assembly.

With reference to the figures, a sprinkler, generally indicated by the reference numeral 1, is connected by means of a connecting element 2 to a pipe 3 for feeding pressurized water. A rotating joint, generally indicated by the reference numeral 4, is fixed on the connecting element 2 and comprises a fixed lower portion 5, which is bolted to the element 2, and an upper movable portion 6, which supports a rotating assembly generally indicated by the reference numeral 7. The rotation axis a of the joint 4, which is approximately but not necessarily vertical, determines the rotation axis of the assembly 7.

The assembly 7 substantially comprises a barrel 8 connected to the upper portion 6 of the joint 4 by means of an elbow coupling 9, which has an angle θ between the outlet and the inlet so as to incline the barrel 8 with respect to the vertical, and a substantially cylindrical connecting stub pipe 10. A nozzle or nosepiece 12 is fixed to the tubular body 8 at its end portion by means of a ring 11 or the like and has an adapted profile and internal diameter so as to obtain a jet with a preset flowrate and range according to the pressure of the water.

An oscillating arm 20 is pivoted on the head 17 and, in an exemplifying form illustrated in Fig. 1, is constituted by an approximately rectangular frame which is formed by two lateral members 21, 22, arranged on opposite sides with respect to the barrel 8, which are rigidly connected to one another by a rear cross-member 23 and by a front plate 24. The arm may pivot by means of a pair of lateral supports 25, which are crossed by a single axle or by lateral pivots 27.

A deflector 40 is arranged on the plate 24 at a distance B from the nozzle 12 in equilibrium conditions so as to periodically interact with the jet 3.

The sprinkler of the illustrated example also has means for reversing the direction of rotation of the rotating assembly 7 after covering a preset angle. For this purpose, an approximately Z-shaped bracket 60 is pivoted on the oscillation axis b and has a longitudinal portion which is adjacent to the seat 14 of the support 13. An elongated nut 62 is provided at the rear transverse end 61 of the bracket 60 and retains an actuation rod 64 by means of a stop screw 63. The free end 65 of the rod 64 is conveniently shaped so as to be able to interact with two radial stroke limit protrusions, constituted for example by the folded ends of two open rings 66, 67 which are rigidly associated with the fixed lower portion 5 of the joint 4.

According to the invention, the rotating joint 4 comprises a self-adjusting brake structure, generally indicated by the reference numeral 100, particularly but not exclusively intended for use in the sprinkler illustrated in Fig. 1. The connecting element 2 fixed to the water feed pipe 3 can be of the flanged type or of the type with an inner thread, made of brass or of another equivalent material, and is anchored to a torus-like body 101 made of aluminum or the like, with a tapered internal surface which is connected to the connecting element 2.

A pair of braking disks 102,102' made of stainless steel are arranged on the torus-like body 101; said disks have planar portions 103, 103' and inner and outer cylindrical annular portions, respectively 104, 104' and 105, 105'. The braking disks, the torus-like body and the flange are mutually rigidly coupled by means of bolts 106 or the like so as to define, as a whole, a stationary or fixed portion 5 of the joint.

In the upper portion of the figure, the elbow coupling 9 is fixed by means of bolts 107 to a cover 108 which has a planar portion 109 and a cylindrical tubular portion 110 with an internal diameter which is equal to that of the torus-like body 101.

The cover 108 is in turn anchored to a bottom 111 with a cylindrical lateral portion 112 and a planar portion 113. On the respective planar portions 109 and 113, which face the planar surfaces 103, 103' of the braking disks 102, 102', the cover 108 and the bottom 111 have respective series of cylindrical cavities 114, 114' which are angularly spaced. Two braking rings 120, 120' are interposed between the disks and the planar walls of the cover and of the bottom. The rings are made of wear-proof synthetic material and have cylindrical protrusions or dowels 121, 121' which engage in the respective cavities 114, 114', so as to ensure the traction of the rings 120, 120' by the rotating portion of the joint. Helical springs 130 are also provided in the cavities 114 for the dowels 121 of the upper ring 120 and exert on the upper braking ring 120 a compression force against the upper disk 102.

Gaskets of the lip type 140, or of the O-ring type 141, 142, arranged in the respective regions indicated in the drawings, are furthermore provided in order to ensure the tightness of the joint.

The assembly constituted by the elbow coupling 9, the cover 108, the bottom 111 and the braking rings 120, 120' constitutes the rotatable part of the joint. By virtue of the hydraulic pressure, the rotatable part is pushed upward, forcing the lower ring 120' against the lower disk 102' with a pressure which is proportional to that of the water. The friction between the upper ring 120 and the upper disk 102 is instead always ensured by the compression force of the springs 130, which op-

erate even with low pressures and regardless of the attitude of the sprinkler.

Conveniently, according to the invention, the angle of incidence θ and the configuration of the elbow coupling 9 are preset so that the line of action of the reaction force R generated by the jet on the barrel is directed substantially toward the region of contact of the rings and of the disks and also acts on the cylindrical lateral surfaces of these elements.

The simultaneous presence of all these forces ensures that the braking action on the joint is self-adjusted and substantially proportional to the pressure of the water as well as to the composition of the reaction forces which act on the sprinkler, achieving the aim of the invention.

It is also noted that the line of action of the resultant of the reaction forces R on the joint 6 has the minimum lever arm allowed by the geometry of the system, producing an overturning torque which is centered in an axial region of the joint, proximate to the gaskets 140, 141 and 142, with consequent minimal stresses and local deformations of said gaskets.

The rotating joint thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept expressed by the accompanying claims; all the details may furthermore be replaced with technically equivalent elements.

For example, the braking rings inserted in the rotating joint can be executed in a plurality of separate segments instead of in a monolithic structure.

Claims

1. A rotating joint for sprinklers comprising a fixed lower portion (2, 5, 101), connected to said pressurized water pipe (3), and a rotatable upper portion (6, 108, 109), connected to a tubular element (8) and adapted to rotate with respect to said fixed lower portion about a substantially vertical axis, brake means acting on said rotatable upper portion for contrasting the rotation thereof, characterized in that said brake means (100) comprises a pair of opposite disks (102, 102') which are rigidly fixed to said fixed lower portion (2, 5, 101) and a pair of braking rings (120, 120') which are rigidly associated with said rotatable upper portion and act on said disks (102, 102') on opposite sides thereof.

2. Rotating joint according to claim 1, characterized in that said disks (102, 102') have a substantially U-shaped radial cross-section, with a planar annular portion (103, 103') and a pair of cylindrical edges (104, 104'; 105, 105').

3. Rotating joint, according to either claim 1 or 2, characterized in that said braking rings (120, 120') are constituted by annular bodies which have a series of substantially cylindrical angularly spaced pivots (121, 121') arranged on one of their planar faces and intended to be accommodated in corresponding cavities (114, 114') defined in said movable upper portion to be pulled along by the rotation of said movable upper portion.

4. Sprinkler according to one or more of the preceding claims, characterized in that said rotatable upper portion comprises an upper cover (108) and a bottom (111), elastic means (130) being arranged between said cover (108) and the upper braking ring (120), said elastic means being suitable for compressing said upper ring (120) against the respective disk (102).

5. Sprinkler according to one or more of the preceding claims, characterized in that said lower braking ring (120') is rigidly associated with said bottom (111) so that the pressure exerted by the water on the inner surface of said movable upper portion determines a proportional thrust on said lower braking ring (120').

6. Sprinkler according to one or more of the preceding claims, characterized in that said elbow coupling (9) has such an inclination angle (θ) that the line of action of the resultant (R) of the reaction forces exerted by the barrel (8) on said coupling (9) is substantially directed toward the surfaces of mutual contact between said braking rings (120, 120') and said disks (102, 102') so as to increase the braking action proportionally to the energy of the jet.

7. Sprinkler according to one or more of the preceding claims, characterized in that the lever arm of said resultant (R) has minimal dimensions, compatibly with the geometry of the coupling (9), so that the overturning torque of said resultant is approximately centered in an axial region of the joint, proximate to the gaskets (140, 141 and 142), with consequent minimal stresses and local deformations of said gaskets.

8. Sprinkler according to one or more of the preceding claims, characterized in that said elbow coupling (9) is interchangeable with oth-

er ones having different values of said angle (θ) in order to vary the inclination of the jet.

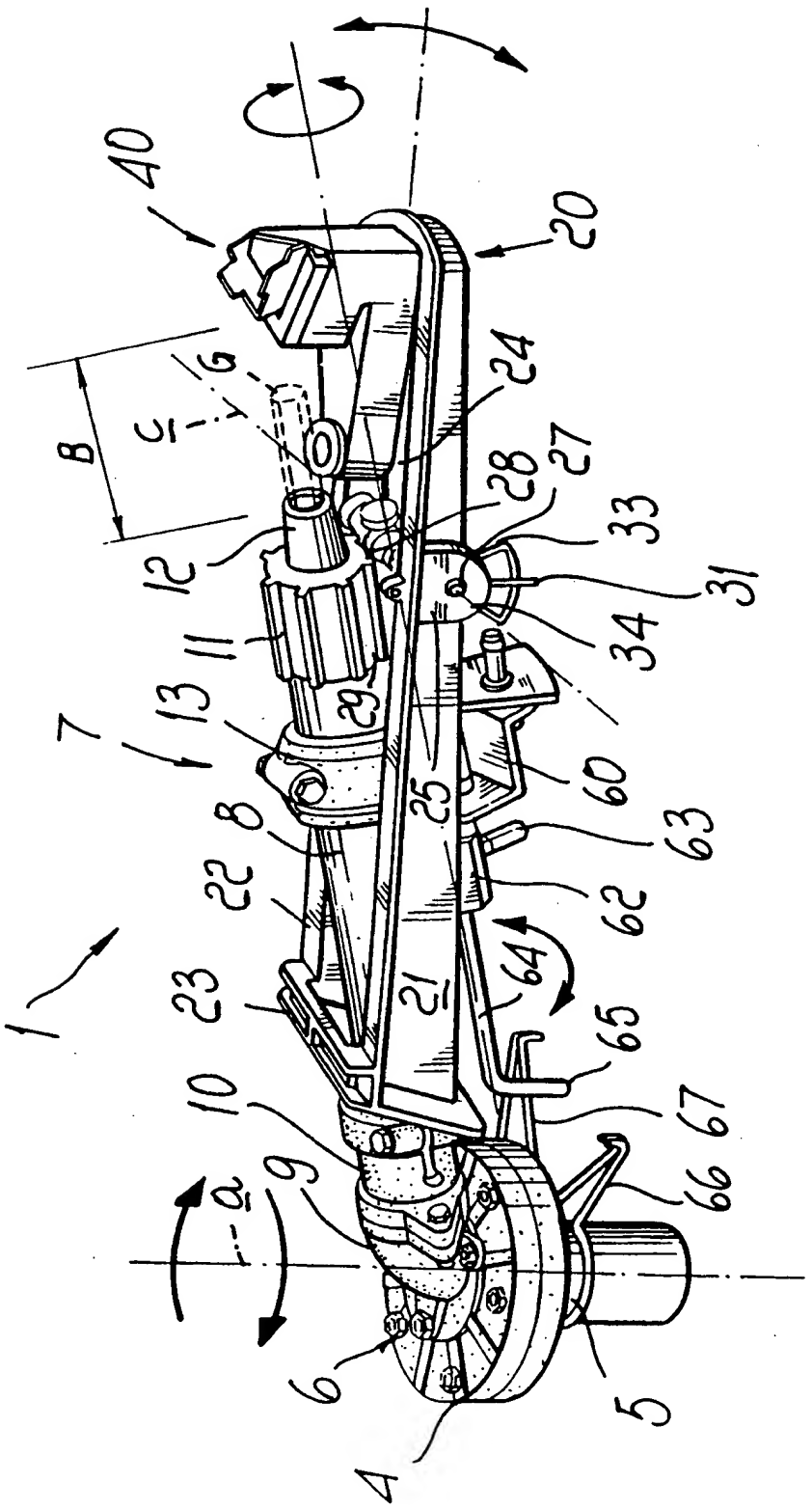
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Fig.1

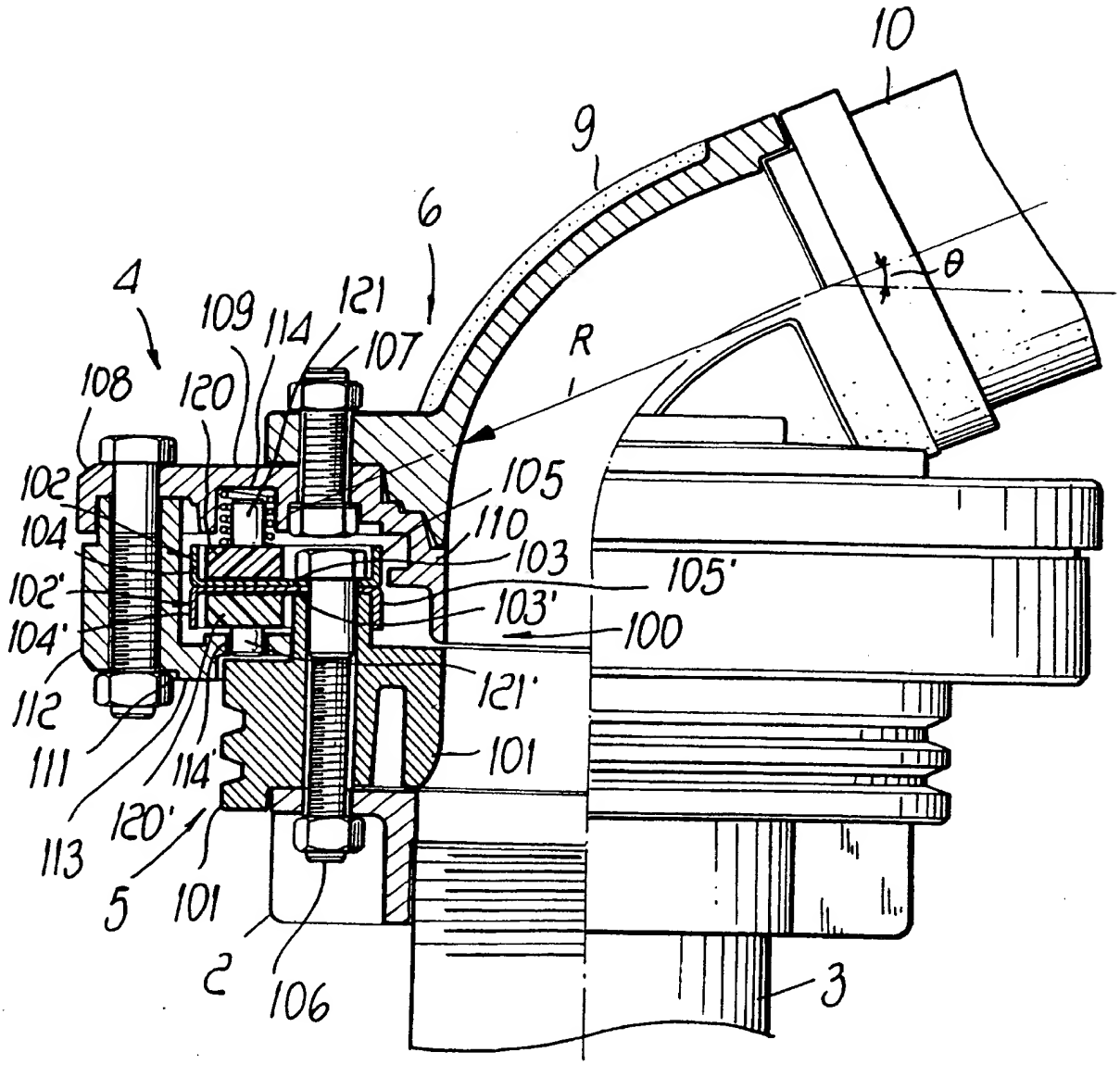
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FIG. 2

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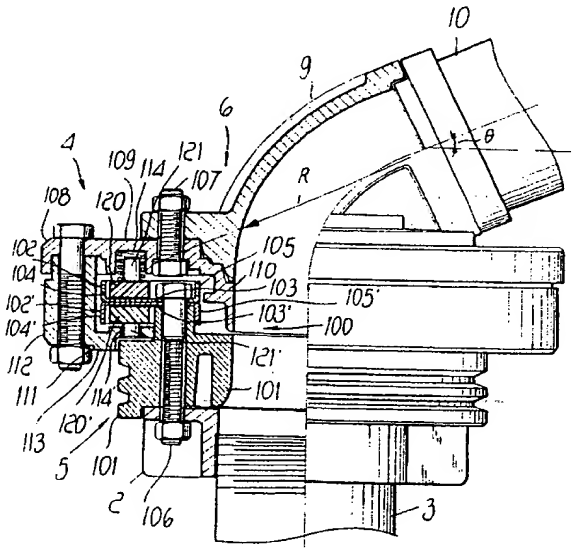

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 94 11 4008

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	AU-A-468 115 (MEYER) * page 12, last paragraph - page 14, line 2; figure 4 *	1	B05B3/16 B05B15/06 F16L27/00 B05B3/02
A	EP-A-0 003 630 (DRECHSEL ARNO) * page 13, line 5 - line 9; claims 2,3; figure 3 *	1	F16L27/08
A	US-A-4 193 548 (MEYER) * the whole document *	1	
A	EP-A-0 025 425 (ÖSTERREICHISCHE SALE-KUNSTSTOFFWERK) * page 10, line 28 - page 11, line 10; figure 7 *	1	
A	US-A-3 744 720 (MEYER) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

B05B
F16L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 January 1995	Guastavino, L

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